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KIMBALL (L ROBERT) AND ASSOCIATES EBENSBURG PA

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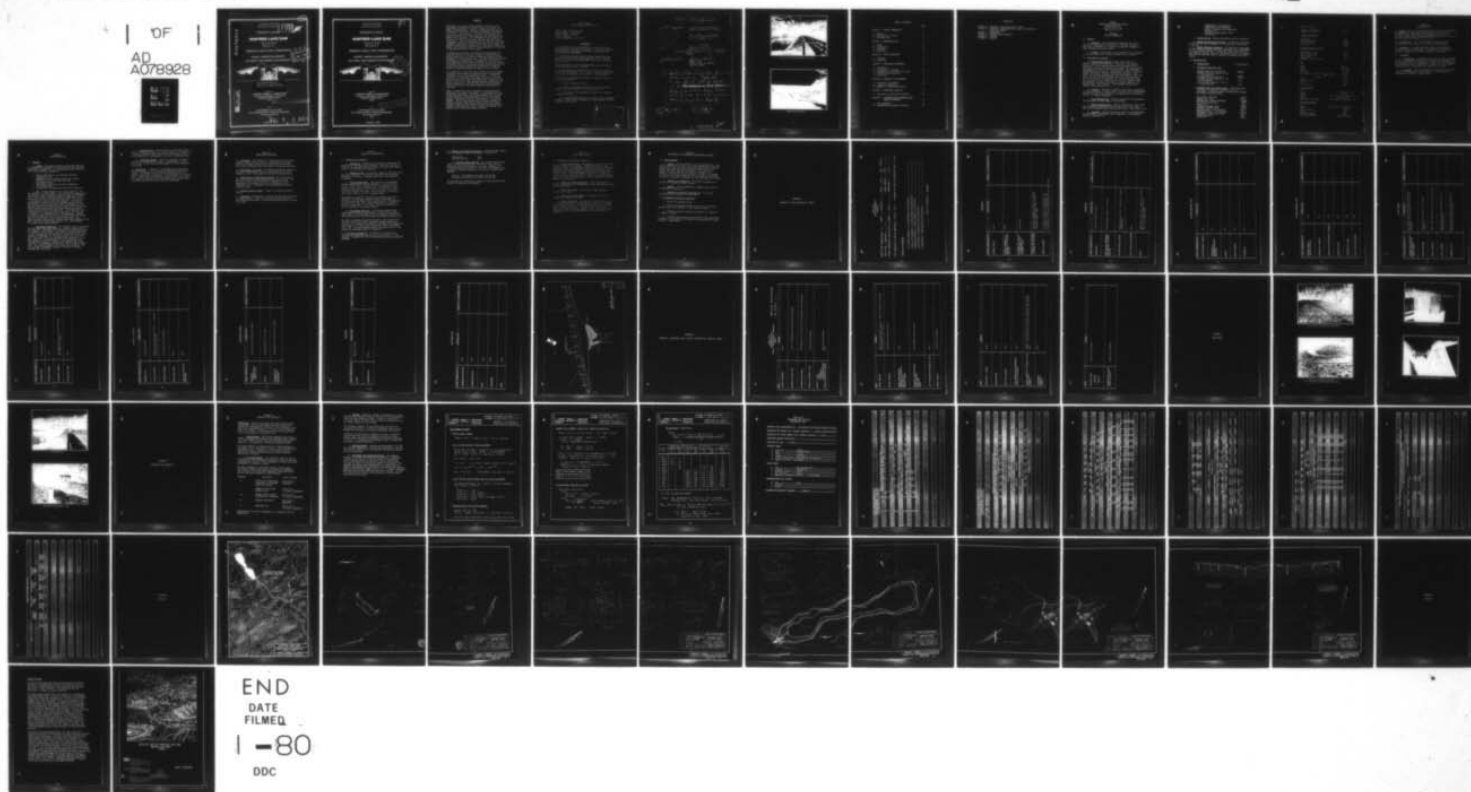
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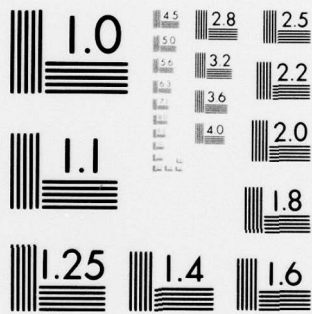
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SUSQUEHANNA RIVER BASIN
TROUT RUN, SULLIVAN COUNTY

PENNSYLVANIA

LEVEL II

HUNTERS LAKE DAM

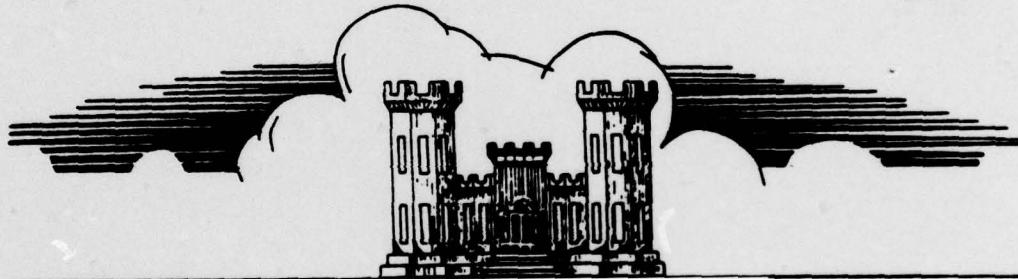
NDS ID NO. PA-356

DER ID NO. 57-1

PENNSYLVANIA FISH COMMISSION

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

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Prepared By

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG, PENNSYLVANIA

15931

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FOR

DEPARTMENT OF THE ARMY
BALTIMORE DISTRICT CORPS OF ENGINEERS
BALTIMORE, MARYLAND

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AUGUST, 1979

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SUSQUEHANNA RIVER BASIN
TROUT RUN, SULLIVAN COUNTY

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PENNSYLVANIA

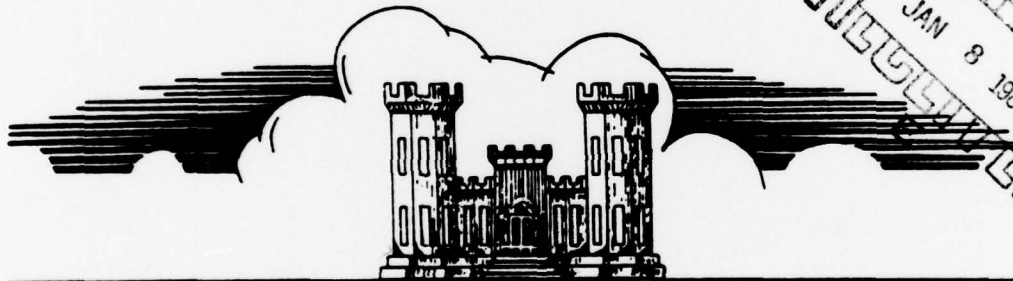
HUNTERS LAKE DAM

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PHASE I INSPECTION REPORT
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AUGUST, 1979

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I REPORT
NATIONAL DAM INSPECTION REPORT

NAME OF DAM: Hunters Lake Dam
STATE LOCATED: Pennsylvania
COUNTY LOCATED: Sullivan
STREAM: Trout Run
DATE OF INSPECTION: May 24, 1979

ASSESSMENT

The assessment of the Hunters Lake Dam is based upon visual observations made at the time of inspection, review of available records and data, hydrology and hydraulic computations, and past operational performance.

The inspection and review of data of Hunters Lake Dam did not reveal any problems which require emergency action. The dam appears to be stable, well maintained, safely operated and in good condition.

Hunters Lake Dam is a high hazard-intermediate size structure. The spillway design flood is the PMF.

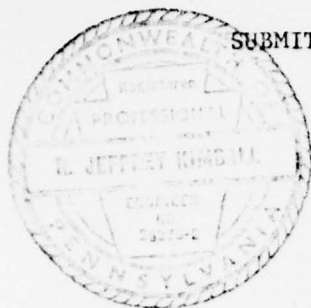
The existing spillway and reservoir are capable of controlling the PMF (Probable Maximum Flood). Based on criteria established by the Corps of Engineers, the spillway is termed adequate.

The following recommendations and remedial measures should be instituted immediately.

1. Repair the upstream paving.
2. Monitor the seepage exiting the rock toe at periodic intervals and during periods of high reservoir levels.
3. Institute a formal inspection program to be conducted at regular intervals.
4. A warning system should be instituted to warn downstream residents of high spillway discharges or during periods of heavy rainfall or high runoff.

REVISION FOR	DATE	BY	DISTRIBUTION	AVAILABILITY CODES	DATE
None	5/24/79	EDD	Unannounced	Available/for special	A

(10) R. Jeffrey/Kimball



SUBMITTED BY:

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS AND ARCHITECTS

R. Jeffrey Kimball
R. Jeffrey Kimball, P.E.

Date

K. Chuang
Kuang-hwei Chuang, P.E.

APPROVED BY:

(15) DACW31-79-C-0009

Date

16 August 1979

James W. Peck
JAMES W. PECK
Colonel, Corps of Engineers
District Engineer

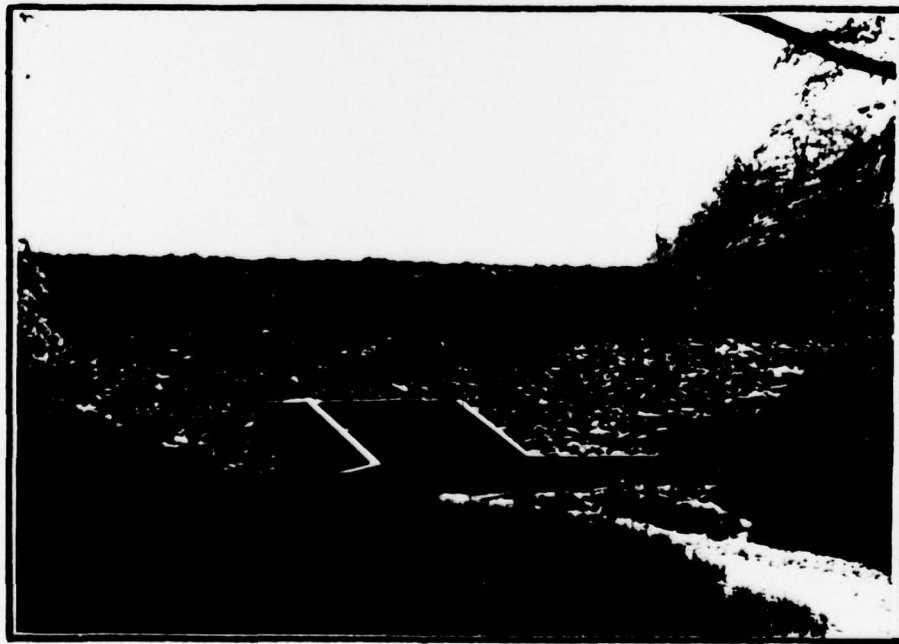
(6) National Dam Inspection Program.
Hunters Lake Dam (NDS ID
Number PA-356 DER ID Number
57-1) ~~Pennsylvania Fish Commission~~
Susquehanna River Basin, Trout
Run, Sullivan Court, Pennsylvania.
Phase I Inspection Report,

(11) Aug 79

(12) 70



Overview of upstream slope and crest.



Downstream overview.

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PHASE I
NATIONAL DAM INSPECTION PROGRAM
HUNTERS LAKE DAM
NDI I.D. NO. PA 356
DER I.D. NO. 57-1

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Hunters Lake Dam is an earthfill dam 450 feet long and 27 feet high. The upstream slope is 3H:1V with concrete paving blocks acting as slope protection. The upstream slope in the lower portion is 3.5H:1V. The downstream slope is 2.5H:1V and grassed. The embankment is homogeneous with a rock toe. Upstream of the dam is a concrete control tower which contains the principal spillway. Flow enters the concrete spillway tower and drops down the tower and into a 48 inch reinforced concrete pipe to an impact basin at the toe of the dam. In addition, the concrete spillway tower has a 4 foot by 5 foot sluice gate to act as a reservoir drain. The emergency spillway is located in a natural saddle at the opposite end of the reservoir. The emergency spillway has a 300 foot long concrete slab. *ASSESS*

b. Location. The dam is located on Trout Run, approximately 2.5 miles northwest of Muncie Valley, Sullivan County, Pennsylvania. Hunters Lake Dam can be located on the Eagles Mere, Pennsylvania U.S.G.S. 7.5 minute quadrangle.

c. Size Classification. Hunters Lake Dam is an intermediate size structure (27 feet high, 2259 acre-feet).

d. Hazard Classification. Hunters Lake Dam is a high hazard dam. Downstream conditions indicate that loss of more than a few lives is probable should the structure fail. (See section 3.1e).

e. Ownership. Hunters Lake Dam is owned by the Commonwealth of Pennsylvania, Pennsylvania Fish Commission. Correspondence should be addressed to:

Commonwealth of Pennsylvania
 Pennsylvania Fish Commission
 Bureau of Fisheries and Engineering
 Robinson Lane
 Bellefonte, Pennsylvania 16823
 814-359-2754

f. Purpose of Dam. Hunters Lake Dam is used for recreation.

g. Design and Construction History. The dam was constructed by the American Asphalt Company in 1970 replacing a previous dam at the site.

h. Normal Operating Procedures. The reservoir is maintained at the principal spillway crest with the excess inflow discharging over the principal spillway. During high flows, water flows out the emergency spillway located at the opposite end of the reservoir. Each year the reservoir drain is opened for inspection and lubrication.

1.3 Pertinent Data.

a. Drainage Area. 1.3 square miles

b. Discharge at Dam Site (cfs).

Maximum known flood at dam site	Unknown
Principal spillway capacity at top of dam elevation	280
48" drainline at normal pool	Unknown
Emergency spillway capacity at top of dam elevation	7560
Total spillway capacity at top of dam elevation	7840

c. Elevation (U.S.G.S. Datum) (feet). - Elevations based on normal pool elevation 1563 shown on U.S.G.S. quadrangle. Elevations shown on construction drawings are from an arbitrary datum.

Top of dam - low point	1568.2
Design top of dam	1568.0
Maximum pool - design surcharge	Unknown
Full flood control pool	N/A
Normal pool	1563.0
Principal spillway crest	1563.0
Emergency spillway crest	1563.8
Upstream portal - 48" drainline	1547.0
Downstream portal - 48" drainline	1541.1
Streambed at centerline of dam	1541.0
Maximum tailwater	None
Toe of dam	1541.1

d. Reservoir (feet).

Length of maximum pool	5500
Length of normal pool	5500

e. Storage (acre-feet).

Normal pool	1224
Flood control pool	N/A
Design surcharge	Unknown
Top of dam	1840

f. Reservoir Surface (acres).

Top of dam	140
Maximum pool (PMF)	135
Flood control pool	N/A
Normal pool	117
Emergency spillway crest	117

g. Dam.

Type	Earthfill
Length	450 feet
Height	27 feet
Top width	15 feet
Side slopes - Upstream - Upper portion	3H:1V
Lower portion	3.5H:1V
Downstream	2.5H:1V
Zoning	None
Impervious core	None
Cutoff	None
Grout curtain	None

h. Reservoir Drain.

Type	48" concrete pipe
Length	140 feet
Closure	Sluice gate in concrete tower
Access	Concrete tower
Regulating facilities	Sluice gate in concrete tower

i. Emergency spillway.

Type	Uncontrolled concrete weir
Length	300 feet
Crest elevation	1563.8
Gates	None
Upstream channel	Lake
Downstream channel	Natural drainage

SECTION 2 ENGINEERING DATA

2.1 Design. Review of information in the files of the Commonwealth of Pennsylvania, Department of Environmental Resources and the Pennsylvania Fish Commission revealed that construction drawings, design reports, permits and specifications were available. All this data was reviewed for this study.

2.2 Construction. The only information available on the construction of the dam were the construction photographs.

2.3 Operation. No formal operating records are maintained on water levels and discharges. The operation and maintenance manual for Hunters Lake Dam was reviewed for this study.

2.4 Evaluation.

a. Availability. Engineering data were provided by PennDER Bureau of Dam Safety, Obstructions and Storm Water Management and by the Pennsylvania Fish Commission. Members of the Pennsylvania Fish Commission staff accompanied the inspection team to answer questions on the construction and operation of the dam.

b. Adequacy. The type and amount of design data and other engineering information is substantial. The information is sufficient to complete a Phase I Report.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. The onsite inspection of Hunters Lake Dam was conducted by personnel of L. Robert Kimball and Associates accompanied by members of the Fish Commission staff on May 24, 1979. The inspection consisted of:

1. Visual inspection of the retaining structure, abutments and toe.
2. Examination of the spillway facilities, exposed portions of any outlet works and other appurtenant works.
3. Observations affecting the runoff potential of the drainage basin.
4. Evaluation of the downstream area hazard potential.

b. Dam. The dam appears to be in good condition. The dam appears to conform closely to the construction drawings with the exception that an arbitrary datum was used for elevations. From a brief survey conducted during the inspection it was noted that the crest of the dam is fairly even. The low point on the dam was located at the right abutment. The crest is approximately 12 feet wide with a bituminous paving surface. The upstream slope above the water level was measured at 3H:1V and was covered with concrete paving blocks for slope protection. These concrete paving blocks have been displaced at several areas particularly near the water level. The downstream slope is measured at 2.5H:1V and covered with grass. The rock toe is exposed at the downstream toe of the embankment. Seepage was noted exiting from the rock toe and from a CMP pipe located near the toe adjacent to the concrete impact basin. The design drawings indicate that a partial cutoff was provided for the dam. The dam was founded upon glacial till. Under seepage is probable with these conditions.

c. Appurtenant Structures. The reservoir level is maintained by the principal spillway located in a concrete intake tower in the reservoir. The reservoir is drained by a sluice gate located in a concrete control tower. Water from the principal spillway or from the drain flow through the 48" reinforced concrete pipe beneath the embankment to a concrete basin at the toe of the dam. The control tower and the impact basin appeared to be in good condition. No deterioration of the concrete was noted. The emergency spillway is located at the opposite end of the reservoir. The emergency spillway has a 300 foot long concrete weir. The concrete appears to be in very good condition. The flow through the emergency spillway is diverted to another drainage area (Rock Run).

d. Reservoir Area. The watershed is covered with woodland. The reservoir slopes are not considered to be susceptible to massive landslides which would affect the storage volume of the reservoir or overtopping of the dam by displacing water.

e. Downstream Channel. Trout Run downstream of Hunters Lake Dam is a steep narrow channel. Approximately 14 homes are located in the flood area approximately 2 miles downstream of the dam.

3.2 Evaluation. In general, the embankment and appurtenant structures appear to be in very good condition and well maintained. The seepage exiting from the downstream rock toe should be monitored to determine if flow increases or is turbid. Note: Considerable precipitation occurred prior to and during the inspection possibly concealing minimum seeps or wet areas. Dry weather inspections by the owner are encouraged.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures. The reservoir is maintained at the principal spillway crest (elevation 1563.0). During periods of high runoff the emergency spillway discharges flow into Rock Run. The reservoir drainline and sluice gate are exercised each year.

4.2 Maintenance of the Dam. No planned maintenance schedule is utilized. Maintenance of the dam is performed by the Fish Commission staff. Maintenance of the dam is considered good.

4.3 Maintenance of Operating Facilities. The sluice gate in the control tower is exercised and lubricated each year. The new valve stem on the sluice gate was installed in 1979. Maintenance of operating facilities is performed by Fish Commission staff. Maintenance of the operating facilities is considered good.

4.4 Warning System in Effect. There is no warning system in effect.

4.5 Evaluation. Maintenance of the dam and operating facilities is considered good. There is no warning system in effect to warn downstream residents of large spillway discharges or failure of the dam.

SECTION 5
HYDRAULICS AND HYDROLOGY

5.1 Evaluation of Features.

a. Design Data. Hydraulic and hydrologic information are contained in the construction drawings. This data consists of principal and emergency spillway rating curves and area capacity curves. No other data was available.

b. Experience Data. No rainfall, runoff or reservoir level data were available. The spillway reportedly has functioned adequately in the past. Maximum water level in the reservoir is unknown.

c. Visual Observations. The concrete in the emergency spillway and principal spillway appeared to be in good condition. Normal flow is maintained by the principal spillway located in the concrete control tower. In addition to the principal spillway weir a wet well is located in the control tower with removable stoplogs. The sluice gate is located in the control tower to act as a reservoir drain.

The emergency spillway is located at the opposite end of the reservoir. The emergency spillway crest is approximately .8 feet higher than the principal spillway weir. The emergency spillway is 300 feet long. The spillway has low concrete walls on either side 1.7 feet high. Above the concrete wall flow is confined in the natural saddle.

d. Overtopping Potential. Overtopping potential was investigated through the development of the probable maximum flood (PMF) for the watershed and the subsequent routing of the PMF and fractions of the PMF through the reservoir and spillway.

The Corps of Engineers, Baltimore District, has directed that the HEC-1 Dam Safety Version systemized computer program be utilized. The program was prepared by the Hydrologic Engineering Center (HEC), U.S. Army Corps of Engineers, Davis, California, July, 1978. The major methodologies or key input data for this program are discussed briefly in Appendix D.

5.2 Evaluation Assumptions. To enable us to complete the hydraulic and hydrologic analysis for this structure, it was necessary to assume that flow is maintained through the principal spillway.

5.3 Summary of Overtopping Analysis. Complete summary sheets from the computer output are presented in Appendix D.

Peak inflow	4127
Spillway capacity	7840

a. Spillway Adequacy Rating. The Spillway Design Flood (SDF) for this dam is the PMF. The SDF is based upon the hazard and size classification of the dam. Based on the following definition provided by the Corps of Engineers, this spillway is rated as adequate as a result of our hydrologic analysis.

Adequate - Intermediate size dams in which the spillway and reservoir can safely pass the PMF.

The spillway and reservoir are capable of controlling the PMF without overtopping the embankment.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. The seepage at the toe of the dam should be monitored at periodic intervals and during high reservoir levels. The remainder of the dam appears to be in good condition. No erosion slumping was noted on the slopes. The upstream concrete paving blocks have been displaced particularly at water level. This displacement is believed to be from ice action or erosion under the blocks. Based on the visual observations at the time of inspection, the static stability of the dam appeared to be adequate.

b. Design and Construction Data. Drill logs and soils testing information were available for review. No stability analysis was performed.

c. Operating Records. There are no formal operating records for the dam.

d. Post-Construction Changes. There have been no post-construction changes to the dam.

e. Seismic Stability. The dam is located in seismic zone 1. No seismic stability analysis has been performed. Normally, it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake loading. Because of the low risk of seismic occurrence and the visual observations, no static analysis is required.

SECTION 7
ASSESSMENT AND RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. The dam appears to be in good condition. The visual observations, review of available information, hydrologic calculations, and past operational performance indicate that Hunters Lake Dam's spillway is adequate. The spillway is capable of controlling the PMF without overtopping. No stability analysis has been performed on the dam. The seepage at the toe of the dam through the rock toe should be monitored at periodic intervals to determine if flow increases or is turbid.

b. Adequacy of Information. Sufficient information is available to complete a Phase I Report.

c. Urgency. The recommendations suggested below should be implemented immediately.

d. Necessity for Further Investigation. No further investigations are required at this time.

7.2 Recommendations/Remedial Measures.

1. Repair the upstream paving.
2. Monitor the seepage exiting the rock toe at periodic intervals and during periods of high reservoir levels.
3. Institute a formal inspection program to be conducted at regular intervals.
4. A warning sytem should be instituted to warn downstream residents of high spillway discharges or during periods of heavy rainfall or high runoff.

APPENDIX A

CHECKLIST, VISUAL INSPECTION, PHASE I

CHECK LIST
VISUAL INSPECTION
PHASE I

NAME OF DAM Hunters Lake COUNTY Sullivan STATE PA ID# PA 356
 TYPE OF DAM Earthfill HAZARD CATEGORY High
 DATE(s) INSPECTION May 24, 1979 WEATHER Rainy TEMPERATURE 60°
 POOL ELEVATION AT TIME OF INSPECTION 1563.2 M.S.L. TAILWATER AT TIME OF INSPECTION None M.S.L.

INSPECTION PERSONNEL:

R. Jeffrey Kimball - L. Robert Kimball and Associates
James T. Hockensmith - L. Robert Kimball and Associates
Kuang Hwei Chuang - L. Robert Kimball and Associates
Jon Grindell - Pennsylvania Fish Commission
Danny Oneill - Pennsylvania Fish Commission

James T. Hockensmith RECORDER

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	None noted.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Horizontal alignment appears to be good. Vertical alignment-near right abutment-low point equals 1568.2.	
RIPRAP FAILURES	No riprap. Concrete paving blocks act as slope protection. Displacement and distortment of concrete paving blocks near water level.	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
VEGETATION	Grass on downstream slope.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Both abutments appear to be good.	
ANY NOTICEABLE SEEPAGE	Seepage from rock toe. Quantity of seepage undetermined.	
STAFF GAUGE AND RECORDER	None.	
DRAINS	Underdrain in rock toe. Water was flowing out of one of these under drains to left of the impact basin.	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	
STAFF GAUGE OR RECORDER	N/A	

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	48" concrete pipe line observed except the discharge concrete appeared to be in good condition.	
INTAKE STRUCTURE	Concrete tower appears to be in good condition.	
OUTLET STRUCTURE	Impact basin appeared to be in good condition.	
OUTLET CHANNEL	Outlet channel was in good condition. No obstructions noted.	
EMERGENCY GATE	Sluice gate on 48" drain line unobserved. The stem was repaired recently.	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition.	
APPROACH CHANNEL	Lake.	
DISCHARGE CHANNEL	Discharge channel is a natural drainage way formed by a saddle.	
BRIDGE AND PIERS	None.	

PRINCIPAL SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	In good condition.	
INTAKE STRUCTURE	Intake is concrete control tower. It appeared to be in good condition.	
DISCHARGE CHANNEL	48" concrete pipe unobserved.	
BRIDGE AND PIERS	None.	
GATES AND OPERATION EQUIPMENT	None.	

DOWNSTREAM CHANNEL

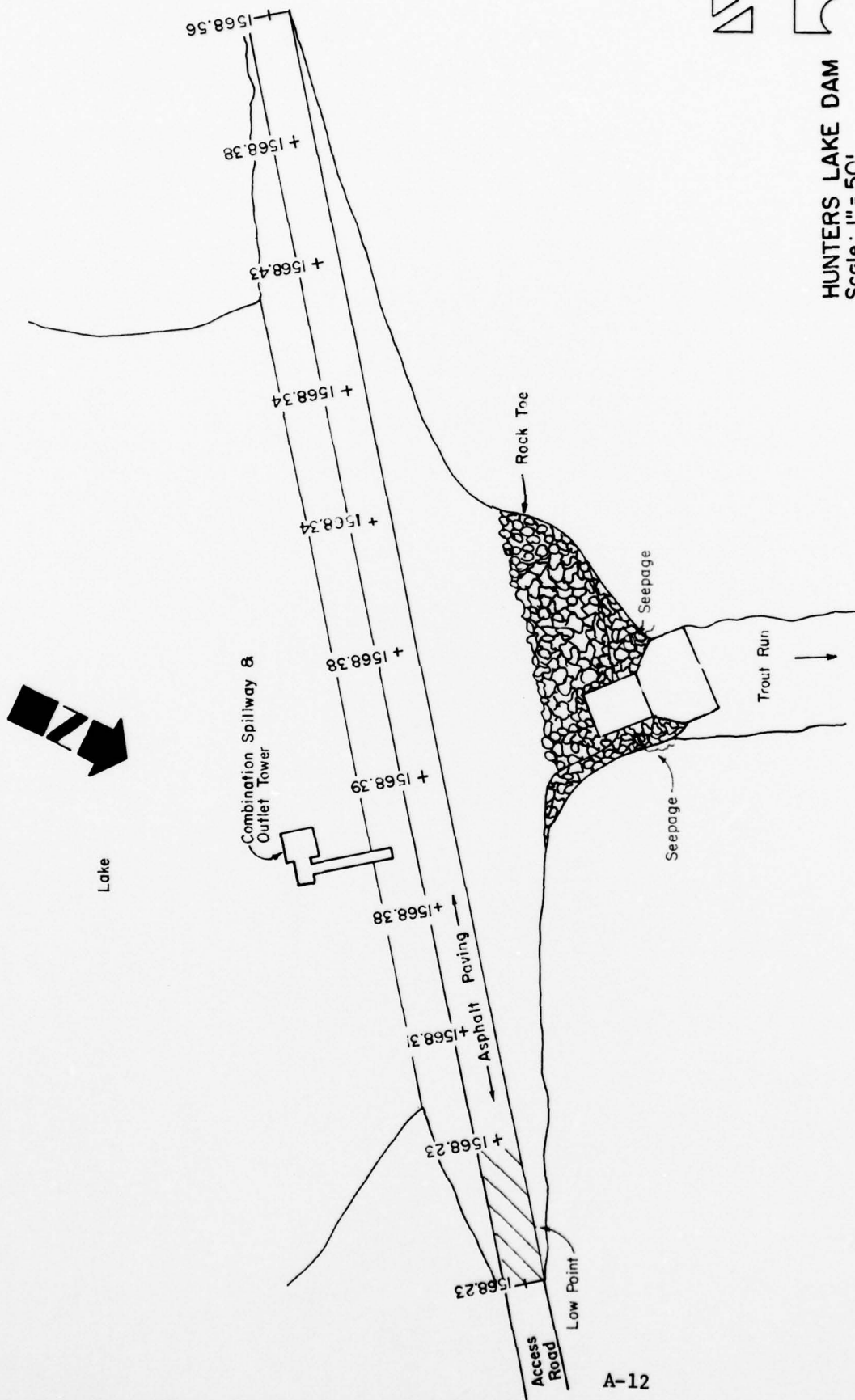
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Narrow and steep downstream channel.	
SLOPES	Slopes appeared to be stable.	
APPROXIMATE NO. OF HOMES AND POPULATION	Approximately 14 homes with 56 people.	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Moderately steep.	
SEDIMENTATION	Minor.	

INSTRUMENTATION

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None.	
OBSERVATION WELLS	None.	
WEIRS	None.	
PIEZOMETERS	None.	
OTHER	None.	



APPENDIX B

CHECKLIST, ENGINEERING DATA, DESIGN, CONSTRUCTION, OPERATION, PHASE I

2

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM Hunters Lake Dam
 ID# PA 356

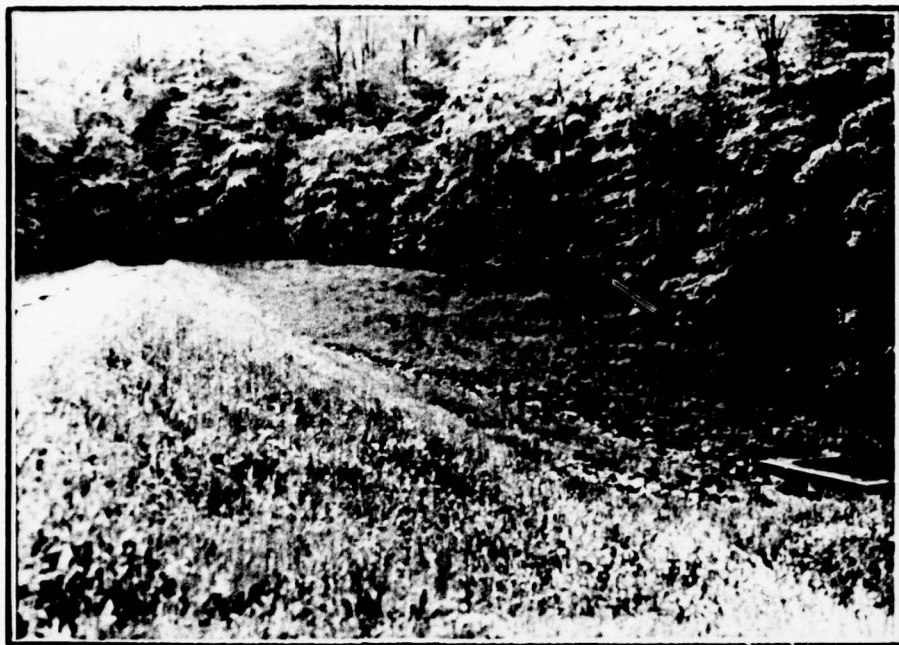
ITEM	REMARKS
AS-BUILT DRAWINGS	None.
REGIONAL VICINITY MAP	U.S.G.S. quadrangle and construction drawings.
CONSTRUCTION HISTORY	Photographs of construction by Pennsylvania Fish Commission.
TYPICAL SECTIONS OF DAM	Construction Drawings.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS RAINFALL/RESERVOIR RECORDS	Construction Drawings. None.

ITEM	REMARKS
DESIGN REPORTS	Report by Geotechnical Services. Report consists of drilling and laboratory test results.
GEOLOGY REPORTS	Geotechnical Services report.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Geotechnical Services report.
POST-CONSTRUCTION SURVEYS OF DAM	None.
BORROW SOURCES	Construction drawings.

ITEM	REMARKS
MONITORING SYSTEMS	None.
MODIFICATIONS	None.
HIGH POOL RECORDS	None.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Prior to construction of new dam in 1970 the old dam had failed. The old dam was located upstream of the existing dam.
MAINTENANCE OPERATION RECORDS	None.

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	Construction drawings.
OPERATING EQUIPMENT PLANS & DETAILS	Construction drawings.

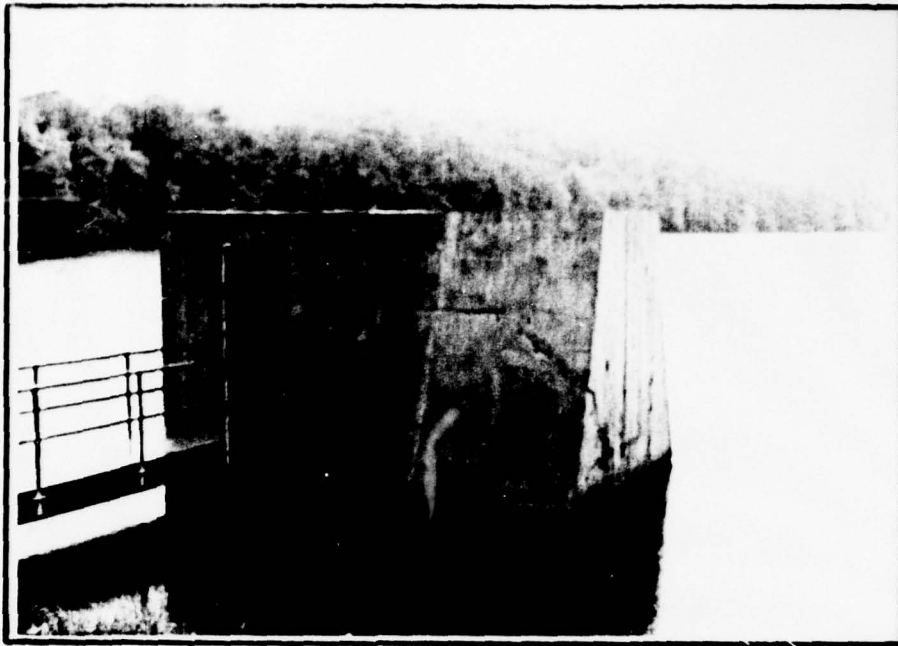
APPENDIX C
PHOTOGRAPHS



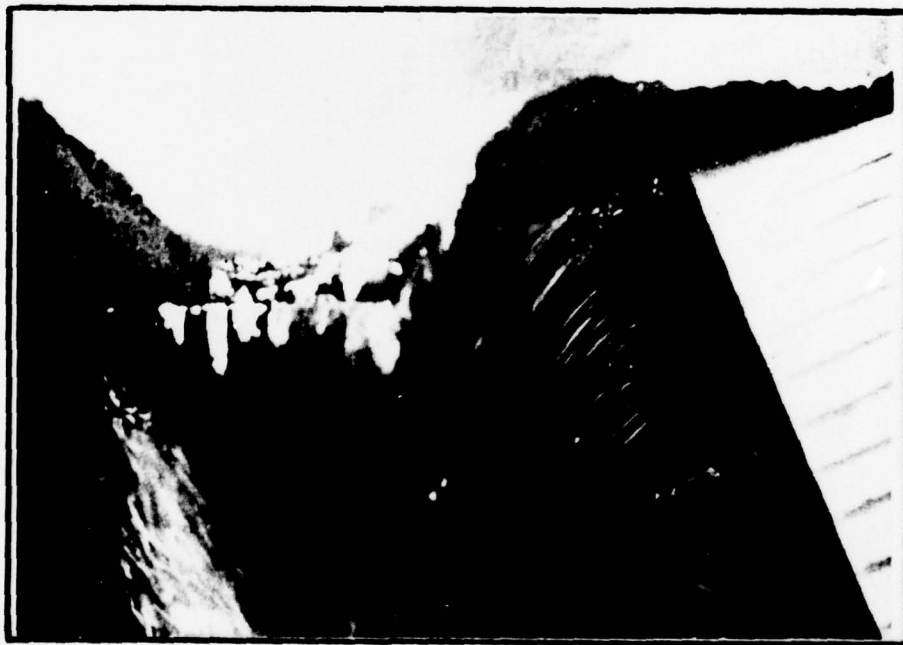
Downstream slope and left abutment.



Immediate downstream exposure.
Note perforated metal underdrain pipe.



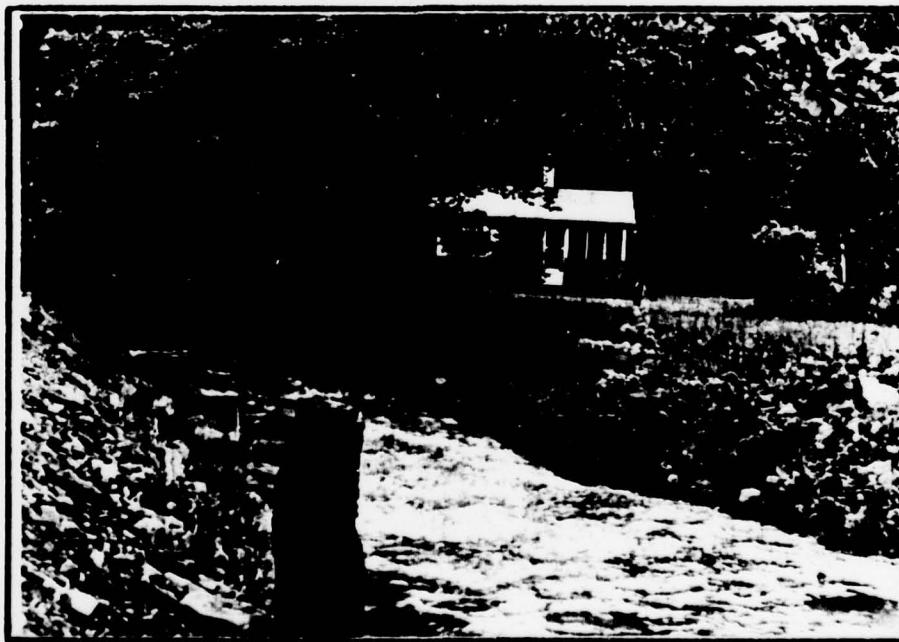
Principal spillway intake.



Inside principal spillway intake.



Spillway weir.



Residence downstream of dam.

APPENDIX D
HYDROLOGY AND HYDRAULICS

APPENDIX D
HYDROLOGY AND HYDRAULICS

Methodology. The dam overtopping and breach analyses were accomplished using the systemized computer program HEC-1 (Dam Safety Investigation), September, 1978, prepared by the Hydrologic Engineering Center, U.S. Army Corps of Engineers, Davis, California. A brief description of the methodology used in the analysis is presented below.

1. Precipitation. The Probable Maximum Precipitation (PMP) is derived and determined from regional charts prepared from past rainfall records including "Hydrometeorological Reports No. 40 prepared by the National Weather Service.

The index rainfall is reduced from 10% to 20% depending on watershed size by utilization of what is termed the HOP Brook adjustment factor. Distribution of the total rainfall is made by the computer program using distribution methods developed by the Corps.

2. Inflow Hydrograph. The hydrologic analysis used in development of the overtopping potential is based on applying a hypothetical storm to a unit hydrograph to obtain the inflow hydrograph for reservoir routing.

The unit hydrograph is developed using the Snyder method. This method requires calculation of several key parameters. The following list gives these parameters their definition and how they were obtained for these analysis.

Parameter	Definition	Where Obtained
C_t	Coefficient representing variations of watershed slope and storage	From Corps of Engineers*
L	Length of main stream channel miles	From U.S.G.S. 7.5 minute topographic
L_{ca}	Length on main stream to centroid of watershed	From U.S.G.S. 7.5 minute topographic
C_p	Peaking coefficient	From Corps of Engineers*
A	Watershed size	From U.S.G.S. 7.5 minute topographic

*Developed by the Corps of Engineers on a regional basis for Pennsylvania.

3. Routing. Reservoir routing is accomplished by using Modified Plus routing techniques where the flood hydrograph is routed through reservoir storage. Hydraulic capacities of the outlet works, spillways and the crest of the dam are used as outlet controls in the routing.

The hydraulic capacity of the outlet works can either be calculated and input or sufficient dimensions input and the program will calculate an elevation discharge relationship.

Storage in the pool area is defined by an area - elevation relationship from which the computer calculates storage. Surface areas are either planimetered from available mapping or U.S.G.S. 7.5 minute series topographic maps or taken from reasonably accurate design data.

4. Dam Overtopping. Using given percentages of the PMF the computer program will calculate the percentage of the PMF which can be controlled by the reservoir and spillway without the dam overtopping.

5. Dam Breach and Downstream Routing. The computer program is equipped to determine the increase in downstream flooding due to failure of the dam caused by overtopping. This is accomplished by routing both the pre failure peak flow and the peak flow through the breach (calculated by the computer with given input assumptions) at a given point in time and determining the water depth in the downstream channel. Channel cross-sections taken from U.S.G.S. 7.5 minute topographic maps were used in the downstream flood wave routing. Pre and post failure water depths are calculated at locations where cross-sections are input.



L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
EDENSBURG PENNSYLVANIA

DAM NAME HUNTERS LAKE

I.D. NUMBER PA. 57-1

SHEET NO. 1 OF 3

BY OTM DATE 6-26-79

HUNTERS LAKE

DRAINAGE AREA

AREA = 1.3 MI² (FROM U.S.G.S. 7.5-MIN. QUAD.)

UNIT HYDROGRAPH PARAMETERS

DAM SITE LOCATED IN ZONE #17, SUSQUEHANNA
RIVER BASIN. FROM CORPS OF ENGINEERS,
BALTIMORE DISTRICT REGIONAL STUDY.

$C_p = 0.45$, $C_t = 1.13$

$L = 1.0$ MI , $L_{ca} = 0.5$ MI (FROM U.S.G.S. 7.5-MIN. QUAD.)

$t_p = (L \times L_{ca})^{0.3} = 1.13 (1 \times 0.5)^{0.3}$

$t_p = 0.92$ HRS. (SNYDERS LAG (t_p) IN HRS.)

LOSS RATE AND BASE FLOW PARAMETERS

AS RECOMMENDED BY CORPS OF ENGINEERS,
BALTIMORE DISTRICT.

STR TL = 1 INCH

CN STL = 0.05 IN/HR

STR Q = 1.50 CFS/MI²

QRCSN = 0.05 (5% OF PEAK FLOW)

RTIOR = 2.00

PROBABLE MAXIMUM STORM

FROM H.R. NO. 40

P.M.P., INDEX RAINFALL = 22.2 (1.0) = 22.2 IN.

$R_6 = 117\%$, $R_{12} = 127\%$, $R_{24} = 136\%$, $R_{48} = 143\%$, $R_{72} = 145\%$



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CONSULTING ENGINEERS & ARCHITECTS
EBENSBURG PENNSYLVANIA

DAM NAME HUNTERS LAKE

I.D. NUMBER PL 57-1

SHEET NO. 2 OF 3

BY OTM DATE 6-26-79

ELEVATION - AREA - CAPACITY RELATIONSHIPS

FROM U.S.G.S. 7.5-MIN. QUAD., AND DER FILES.

AT SPILLWAY CREST ELEV. = 1563.0'

AREA = 117 ACRES

INITIAL STORAGE = 1224.5 AC·FT

AT 1580', AREA = 147 AC.

AT 1600', AREA = 223 AC.

FROM CONIC METHOD FOR RESERVOIR VOLUME.
FLOOD HYDROGRAPH PACKAGE (HEC-1). DAM
SAFETY VERSION (USERS MANUAL).

$$H = 3V/A = 3(1224.5)/117 = 31.4'$$

ELEVATION AT CAPACITY EQUALS ZERO;

$$1563' - 31.4' = 1531.6'$$

ELEV. (FT.)	1531.6	1563	1580	1600
AREA (AC.)	0	117	147	223

DISCHARGE RATING CURVE

PRINCIPAL SPILLWAY

FROM;

$$Q_1 = CLH^{1.5} \quad (\text{PARTIAL FLOW})$$

$$C_1 = 3.3, \quad L = 20.8'$$

FROM;

$$Q_2 = A \sqrt{\frac{2gh}{1.49K}} \quad (\text{FULL FLOW THRU 48" PIPE})$$

INVERT ELEV. = 1541.1'

WHERE $1.49K = 3.24$ (FROM CHOW)



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EBENSBURG PENNSYLVANIA

DAM NAME HUNTERS LAKE
I.D. NUMBER PA. 57-1
SHEET NO. 3 OF 3
BY OTM DATE 6-26-79

EMERGENCY SPILLWAY

FROM;

$$**Q_3 = 8.03 C' h_v^{1/2} (h_p - h_v) [B + Z(h_p - h_v)]$$

$$\text{WHERE } h_v = \frac{3(2Z h_p + B) - \sqrt{6Z^2 h_p^2 + 16Z B h_p + 9B^2}}{10Z}$$

$$C' = 0.95$$

ELEV. (FT.)	SERVICE SPILLWAY				EMERGENCY SPILLWAY		DISCHARGE TOTAL
	WEIR	FLOW	FULL FLOW				
	h_1 (FT.)	Q_1 (cfs)	h_2 (FT.)	Q_2 (cfs)	h_3 (FT.)	Q_3 (cfs)	* Q_T (cfs)
1563	0	0					0
1563.2	0.2	6					10
1563.5	0.5	24					25
1563.8	0.8	49					50
1564	1	69			0.2	80	150
1565	2	194			1.2	1211	1400
1565.5			22.4	265	1.7	2080	2270
1566			22.9	268	2.2	3115	3380
1567			23.9	274	3.2	5660	5930
1568			24.9	280	4.2	8810	9090
1569			25.9	285	5.2	12550	12840
1570			26.9	291	6.2	16880	17170
1571			27.9	296	7.2	21800	22100
1572			28.9	301	8.2	27330	27630

* CFS VALUES ROUNDED

NOTE: THE EMERGENCY SPILLWAY WAS ASSUMED
TRAPEZOIDAL FOR DISCHARGE CALCULATIONS.

** Q_3 FROM; WATER AND WASTEWATER ENGINEERING (11-14) & (11-15)
BY FAIR, GEYER & OKUN

LOW DAMS Eq. (7) & (8)
BY NATIONAL RESOURCES COMMITTEE
WASHINGTON, D.C. 1938

CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 1.3 square miles (wooded, moderately steep)

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 1563.0 (1228 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): N/A

ELEVATION MAXIMUM DESIGN POOL: _____

ELEVATION TOP DAM: 1568.2

SPILLWAY CREST:

- a. Elevation 1563.8
- b. Type concrete weir
- c. Width 1 foot
- d. Length 300 feet
- e. Location Spillover Opposite end of reservoir
- f. Number and Type of Gates None

OUTLET WORKS:

- a. Type 48" concrete pipe
- b. Location Through dam
- c. Entrance inverts 1547.0
- d. Exit inverts 1541.1
- e. Emergency draindown facilities Sluice gate

HYDROMETEOROLOGICAL GAUGES:

- a. Type None
- b. Location _____
- c. Records _____

MAXIMUM NON-DAMAGING DISCHARGE: Unknown

FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF									
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF HUNTERS LAKE									
RATIOS OF PMF ROUTED THROUGH THE RESERVOIR PA 57-F									
1	A1	0	0	0	0	0	0	0	0
2	A2	0	0	0	0	0	0	0	0
3	A3	0	0	0	0	0	0	0	0
4	B1	0	0	0	0	0	0	0	0
5	J	1	1	1	1	1	1	1	1
6	J1	0	0	0	0	0	0	0	0
7									
8									
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100									

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 DAM SAFETY VERSION JULY 1978
 LAST MODIFICATION 26 FEB 79

RUN DATE 11/07/81
 TIME 11:37:00

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
 HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF HUNTERS LAKE
 RATIO OF PMF ROUTED THROUGH THE RESERVOIR

JOB SPECIFICATION

NO	INR	MMIN	IDAY	IMR	IMIN	METRC	IPLT	IPRT	INSTAN
208	0	15	0	0	0	0	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
 PLAN# 1 NR710-1 LR710-1

SUB-AREA RUNOFF COMPUTATION

INFLUX TO RESERVOIR

ISTAO	ICOMP	IECON	ITAPE	JPLT	JPRT	INANE	ISTAGE	IAUTO
1	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5127.	2481.	801.	7853.
CMS	117.	70.	23.	223.
INCHES	17.75	22.93	23.51	23.51
MM	450.66	582.54	597.15	597.15
AC-FT	1290.	1589.	1629.	1629.
THOUS CU M	1517.	1960.	2010.	2010.

*****	*****	*****	*****	*****
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HYDROGRAPH ROUTING

ROUTE THROUGH RESERVOIR									
STAGE	ICOMP	IECON	ITAPE	JPL	JPRT	INAME	STAGE	TAUTO	
2	1	0	0	0	0	0	0	0	
QLOSS	CLOSS	AVG	IPSD	IRPS	ISAME	IOPT	IPMP	LSTR	
0.00	0.000	0.00	0	1	1	0	0	0	
MSIPS	MSIDL	LAG	ANSKE	X	X	X	X	X	
1	0	0	0.000	0.000	0.000	0.000	-1563.	-1	

STAGE	1563.00	1563.20	1563.50	1563.80	1564.00	1565.00	1565.50	1566.00	1567.00
1568.00	1569.00	1570.00	1571.00	1572.00					

FLOW	0.00	5.00	25.00	50.00	150.00	1400.00	2270.00	3380.00	5930.00
9090.00									

SURFACE AREA	0.	117.	147.	223.					
--------------	----	------	------	------	--	--	--	--	--

CAPACITY 1309. 3448. 7122.

ELEVATION 1532. 1563. 1580. 1600.

CNEL SPWD COGN EXPH ELEV ELEV ELEV
1532.0 0.0 0.0 0.0 0.0 0.0

DAM DATA

TOPEL COGD EXPD DAMWD
1568.2 3.0 1.5 450.

STATION 2# PLAN 1: RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

NO.DA HR.MN PERIOD HOURS INFLOW OUTFLOW STORAGE STAGE

1.01	1.19	1	1.25	2.	0.	1209.	1563.0
1.01	1.30	2	1.50	2.	0.	1209.	1563.0
1.01	1.45	3	1.75	1.	0.	1209.	1563.0
1.01	1.00	4	1.00	1.	0.	1209.	1563.0
1.01	1.15	5	1.25	1.	0.	1209.	1563.0
1.01	1.30	6	1.50	1.	0.	1209.	1563.0
1.01	1.45	7	1.75	1.	0.	1209.	1563.0
1.01	2.00	8	2.00	1.	0.	1209.	1563.0
1.01	2.15	9	2.25	1.	0.	1209.	1563.0
1.01	2.30	10	2.50	1.	0.	1209.	1563.0
1.01	2.45	11	2.75	1.	0.	1209.	1563.0
1.01	3.00	12	3.00	1.	0.	1209.	1563.0
1.01	3.15	13	3.25	1.	0.	1209.	1563.0
1.01	3.30	14	3.50	1.	0.	1209.	1563.0
1.01	3.45	15	3.75	1.	0.	1209.	1563.0
1.01	4.00	16	4.00	1.	0.	1209.	1563.0
1.01	4.15	17	4.25	1.	0.	1209.	1563.0
1.01	4.30	18	4.50	1.	0.	1209.	1563.0
1.01	4.45	19	4.75	1.	0.	1209.	1563.0

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
 AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN RATIO	RATIOS APPLIED TO FLOWS
			1	1.00

HYDROGRAPH AT	1	1.30 (2.37)	1	4127 (11686)
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ROUTED TO	2	1.30 (2.37)	1	3540 (10026)
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SUMMARY OF DAM SAFETY ANALYSIS

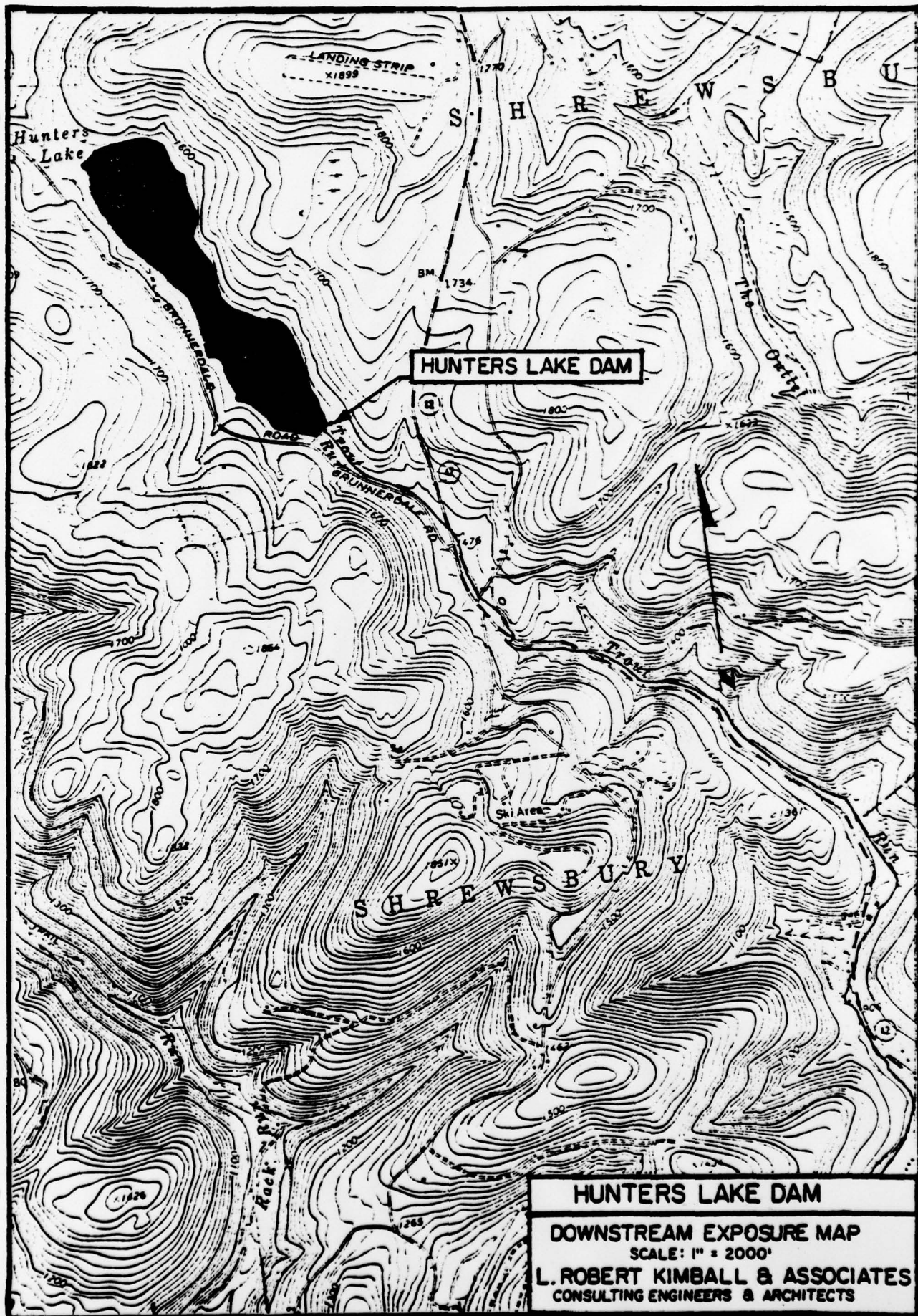
PLAN 1

ELEVATION	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
STORAGE	1563.00	1563.00	1568.20
OUTFLOW	1209.	1209.	1840.
	0.	0.	78408

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	1566.106	0.00	1579.	3940.	0.00	61.25	0.00

APPENDIX E

DRAWINGS

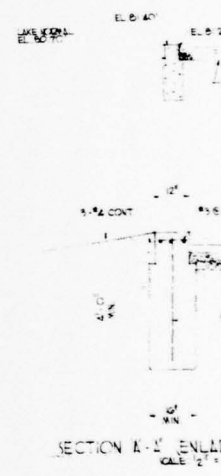


HUNTERS LAKE DAM

DOWNSTREAM EXPOSURE MAP

SCALE: 1" = 2000'

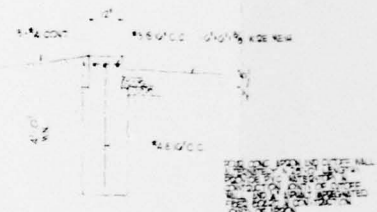
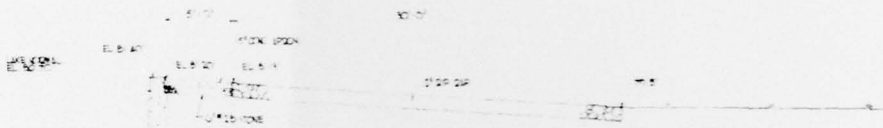
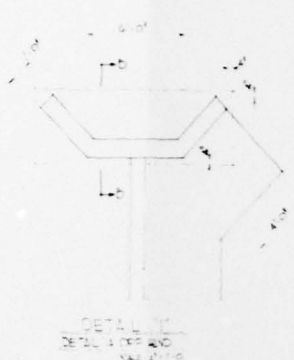
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS



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 TO BE ONLY FORWARDED TO DDC

NOTE:
 ALL DIMENSIONS ARE IN FEET AND INCHES
 UNLESS OTHERWISE SPECIFIED





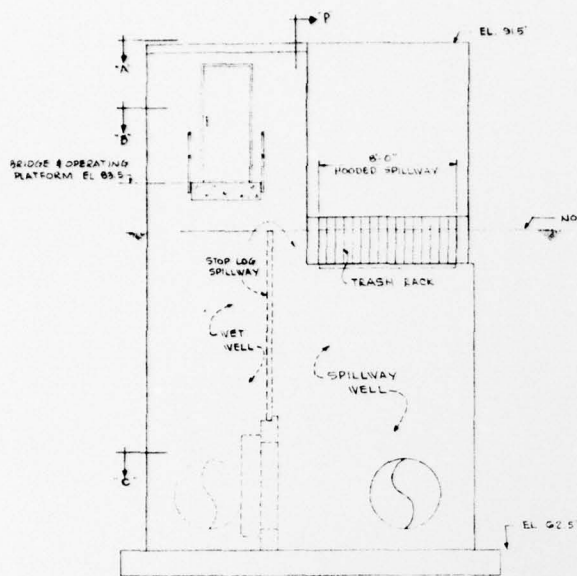
SECTION E (ENLARGED)
SCALE 1" = 10'

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FROM COPY ENLARGED TO 100%

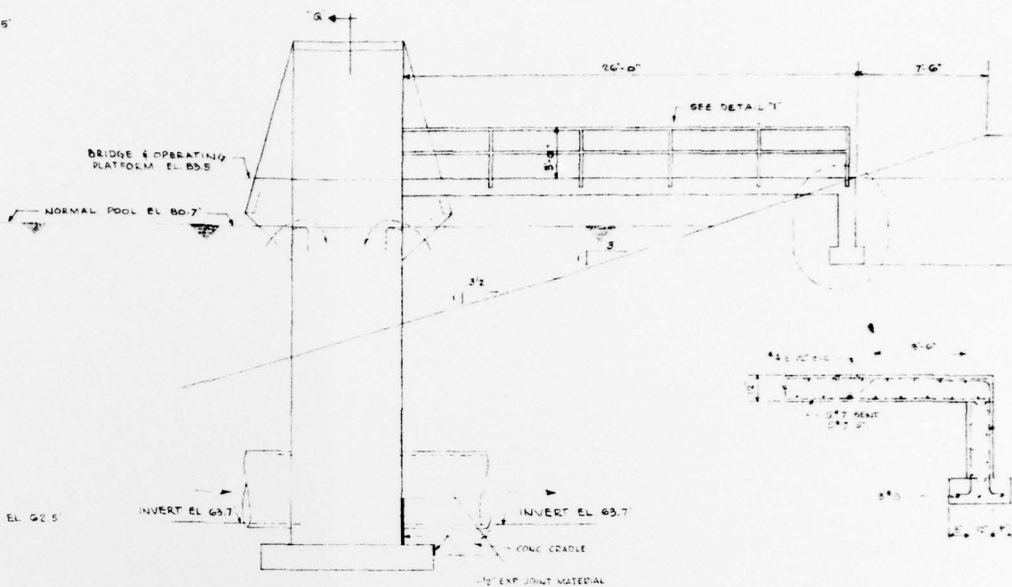


REVISED		APPROVALS		Project No. FC-82L (394-2)	
		APPROVED	<i>Robert C. Skelly</i>	RECONSTRUCTION OF DAM - PLANNY	
		DESIGN CHECKED BY	PENNSYLVANIA FISH COMMISSION	HUNTERS LAKE	
		APPROVAL RECOMMENDED BY	<i>Robert C. Skelly</i>	Construction of Dam and Appurtenances	
		DESIGNED BY	<i>Robert C. Skelly</i>	SHREWSBURY TWP. SULLIVAN COUNTY	
		REGISTERED ENGINEER		ROBERT C. SKELLY, REGISTERED ENGINEER	
		ACCEPTED BY		HARRISBURG, PENNSYLVANIA	
		CONTRACTOR		SCALE	
		BY		COMMONWEALTH OF PENNSYLVANIA	
		DRAWN BY	DATE	DIVISION OF WATER CONSTRUCTION	
		CHECKED BY	DATE	PENNSYLVANIA FISH COMMISSION	
		R.C.S.	8/21/1968	ROBERT J. BOLD, EXEC. DIRECTOR	
				HARRISBURG, PENNSYLVANIA	
				SHEET NO.	
				12	

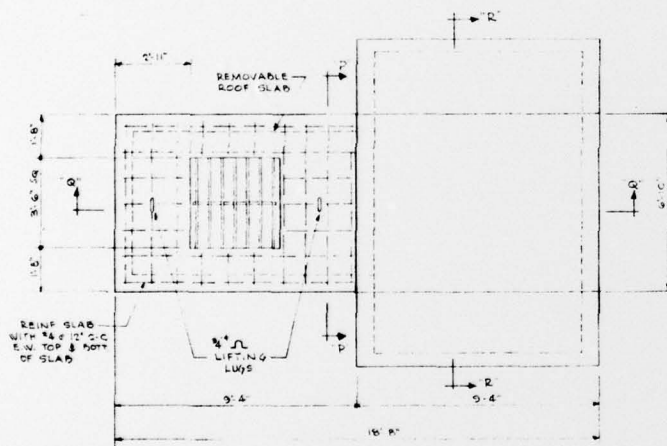
L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
FIGURE 2



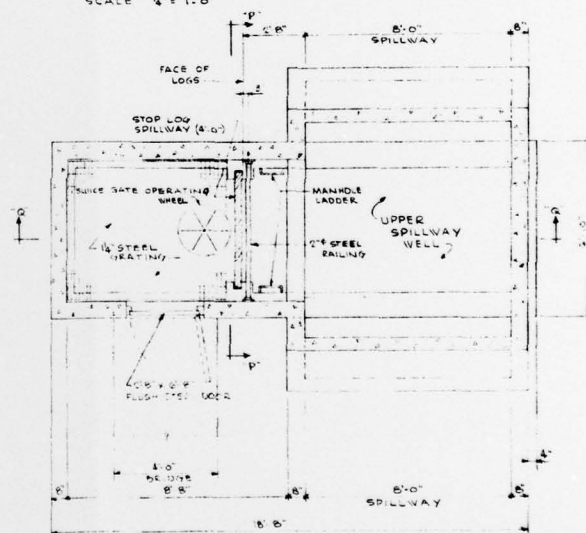
SOUTH ELEVATION
SCALE 1/4" = 1'-0"



WEST ELEVATION
SCALE 1/4" = 1'-0"

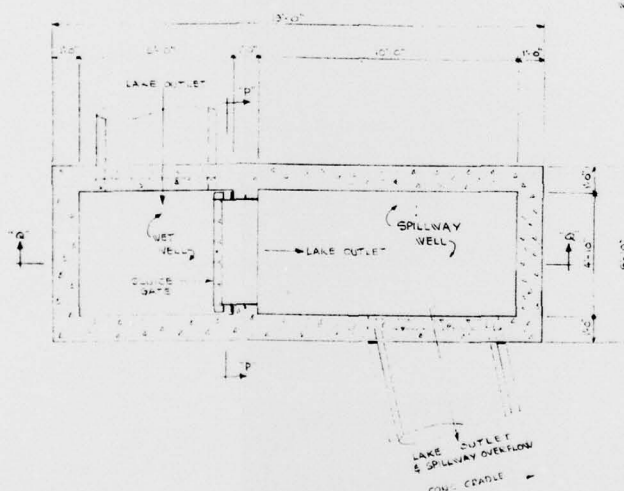
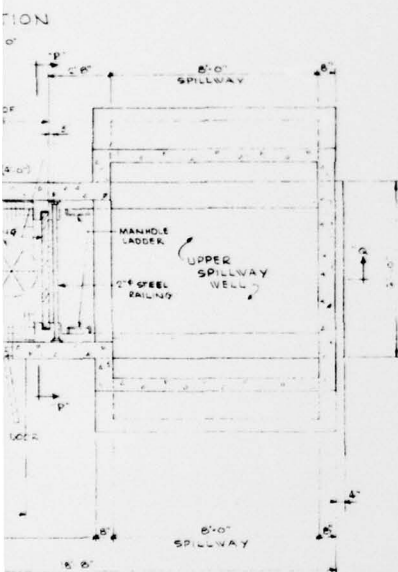
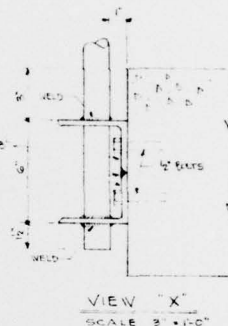
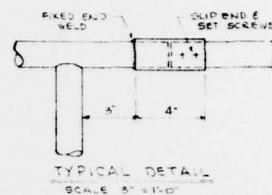
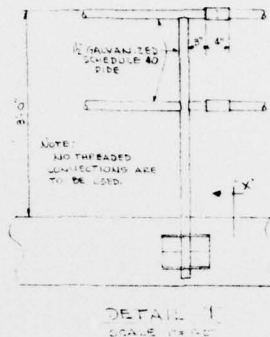
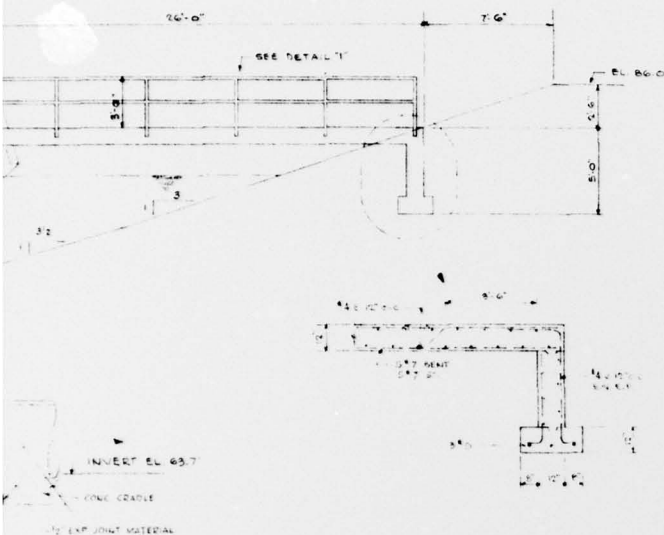


SECTION "A" (ROOF PLAN)
SCALE 3/8" = 1'-0"



SECTION "B"
SCALE 3/8" = 1'-0"

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FROM COPY FORWARDED TO DDG



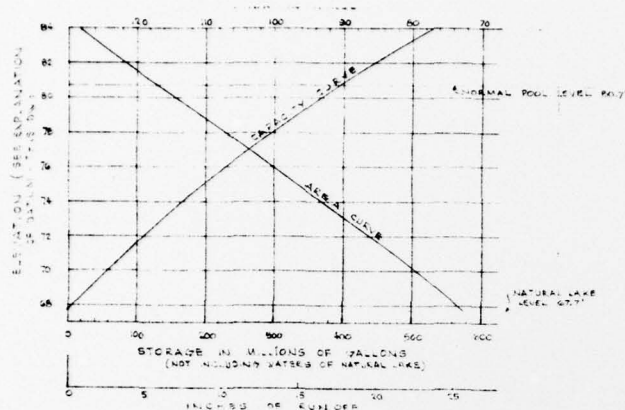
SECTION 'B'
SCALE 3/4" = 1'-0"

SECTION 'C'
SCALE 3/4" = 1'-0"

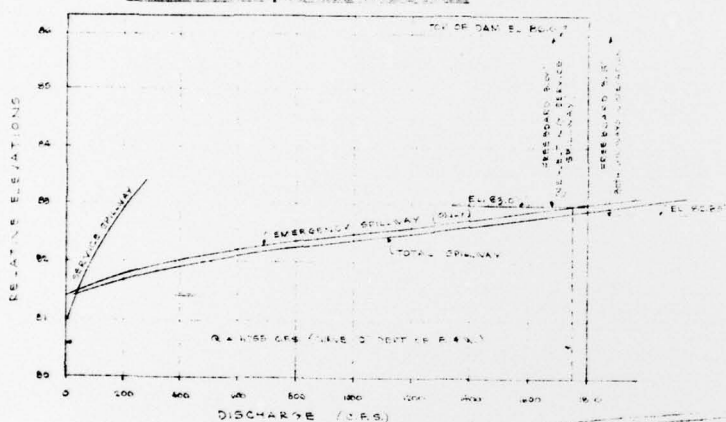
THIS PROJECT IS BEST QUALITY PRACTICE

REVISED	APPROVALS	Project No. FC-82L (394-2)
	APPROVED: <i>Robert C. Kelly</i>	SPILLWAY & OUTLET TOWER
	EXEC. DIRECTOR, PENNSYLVANIA FISH COMMISSION	HUNTERS LAKE
	APPROVAL RECOMMENDED: <i>Edward R. Miller</i>	Construction of Dam and Appurtenances
	ENGINEERING DIVISION - CHIEF ENGINEER	SHREWSBURY TWP. SULLIVAN COUNTY
	SUBMITTED BY: <i>Robert C. Kelly</i>	ROBERT C. KELLY, REGISTERED ENGINEER
	BY: <i>Robert C. Kelly</i>	HARRISBURG, PENNSYLVANIA
	ACCEPTED BY:	SCALE: COMM. OF PENNSYLVANIA
	CONTRACTOR:	BY: PENNSYLVANIA FISH COMMISSION
	BY:	ROBERT J. WELLS, ASST. DIRECTOR
DRAWN BY: S & M	DATE: _____	HARRISBURG, PENNSYLVANIA
CHECKED BY: E. C. S.	DATE: APRIL 1969	SHEET NO. 7
		AS NOTED

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
FIGURE 3

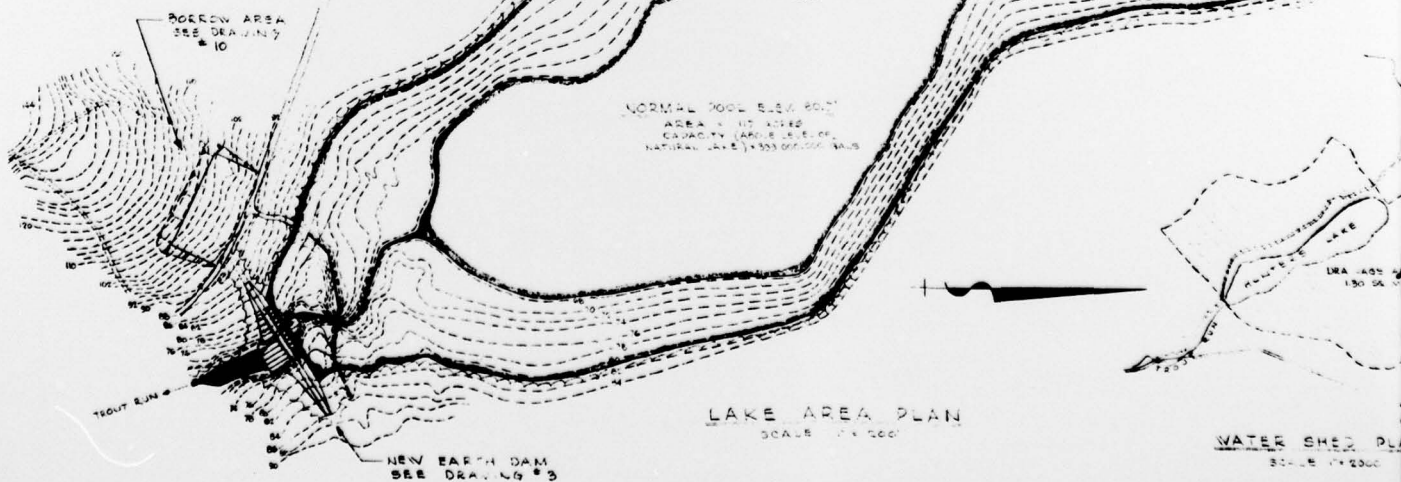


LAKE AREA & CAPACITY CURVES



SPILLWAY DISCHARGE CAPACITY

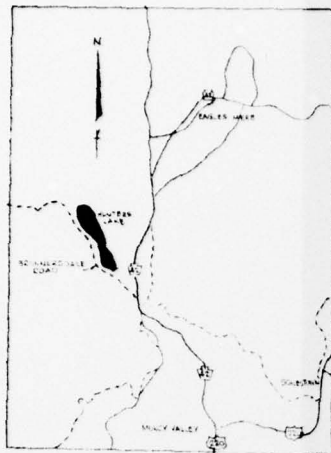
ELEVATIONS SHOWN ARE REFERENCED TO AN ASSUMED ELEVATION OF 600.0 TO OBTAIN APPROXIMATE ELEVATION ABOVE MEAN SEA LEVEL. ADD 1800 FEET TO THOSE SHOWN.



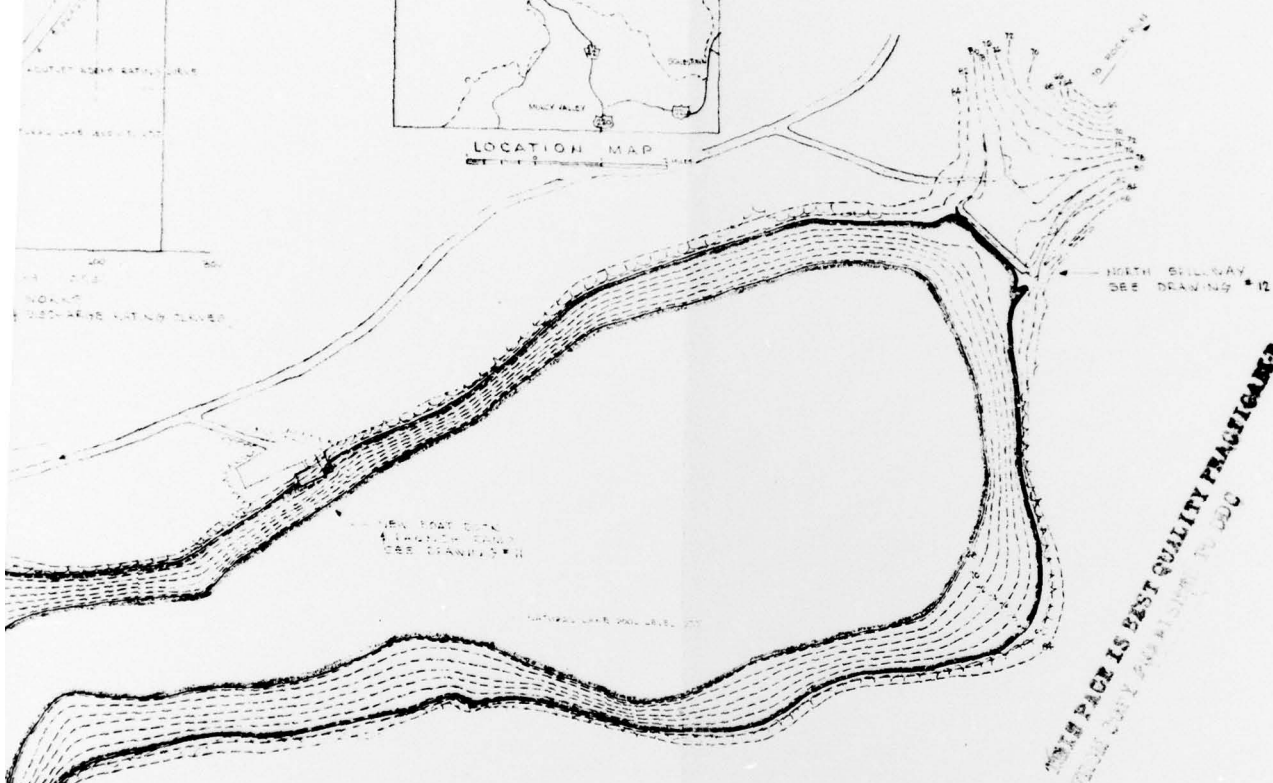
LAKE AREA PLAN
SCALE 1" = 200'

WATER SHED PL.
SCALE 1" = 2000'

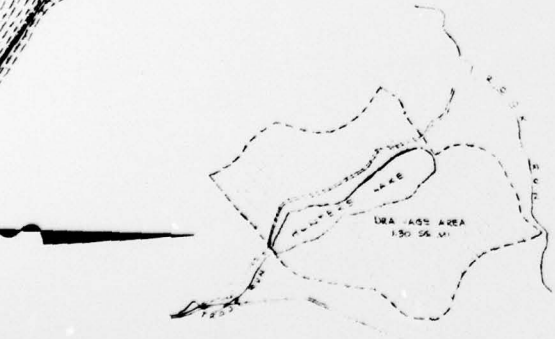
THIS PAGE IS BEST QUALITY FRAGRANCE
IT MAY BE PUBLISHED TO DDC



LOCATION MAP



THIS PAGE IS BEST QUALITY PRACTICES



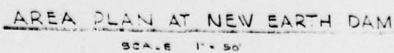
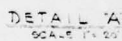
WATER SHED PLAN
SCALE 1" = 2000'

- EXISTING CONTOURS
- - - - - PROPOSED CONTOURS
- EDGE OF WATER - EXISTING NATURAL LAKE
- EDGE OF WATER - PROPOSED LAKE

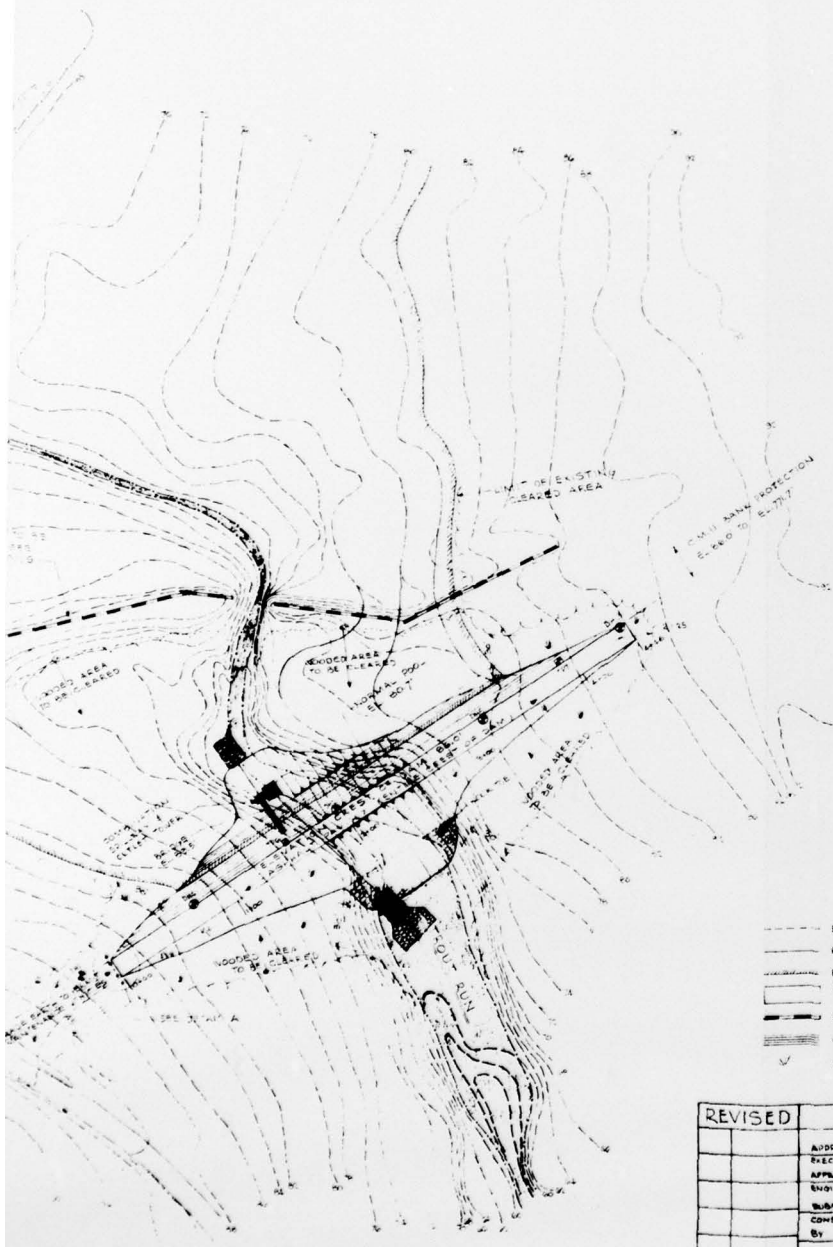
THE TOPOGRAPHIC INFORMATION SHOWN ON THESE DRAWINGS WAS OBTAINED BY THE U.S. FISH AND WILDLIFE SERVICE AND IS BASED ON SURVEYS CONDUCTED BY THAT AGENCY IN 1943-1945.

REVISED		APPROVALS		Project No. FC-82L (394-2)	
		APPROVED <i>Robert C. Kimball</i>		AREA & LOCATION PLANS; AREA-CAPACITY, OUTLET WORKS, SPILLWAY CAPACITY CURVES.	
		EXEC. DIRECTOR, PENNSYLVANIA FISH COMMISSION			
		APPROVAL RECOMMENDED <i>Robert C. Kimball</i>		HUNTERS LAKE	
		PENNSYLVANIA FISH COMMISSION		Construction of Dam and Appurtenances	
		SUBMITTED BY: <i>Robert C. Kimball</i>		SHREWSBURY TWP. SULLIVAN COUNTY	
		CONSULTING ENGINEER		ROBERT C. KIMBALL, REGISTERED ENGINEER	
		ACCEPTED BY:		HARRISBURG, PENNSYLVANIA	
		CONTRACTOR		SCALE	
		BY:		COMMONWEALTH OF PENNSYLVANIA	
		CLAWN BY	DATE	RAYMOND P. SHARER, GOVERNOR	
		CHECKED BY	DATE	PENNSYLVANIA FISH COMMISSION	
		R.C.S.	1001, 1969	ROBERT J. WILCOX, EXEC. DIRECTOR	
				HARRISBURG, PENNSYLVANIA	
				AS SHOWN	SHEET NO. 2

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
FIGURE 4

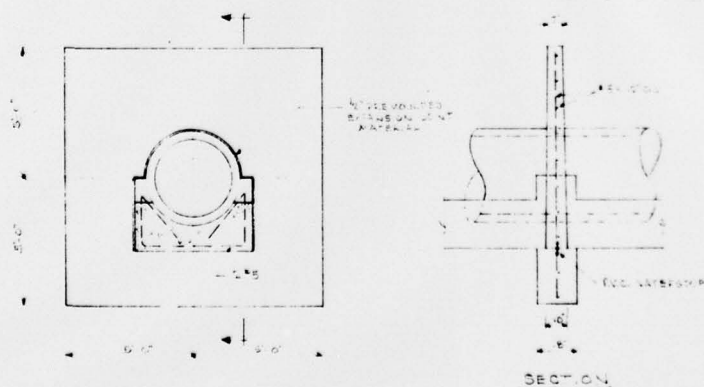
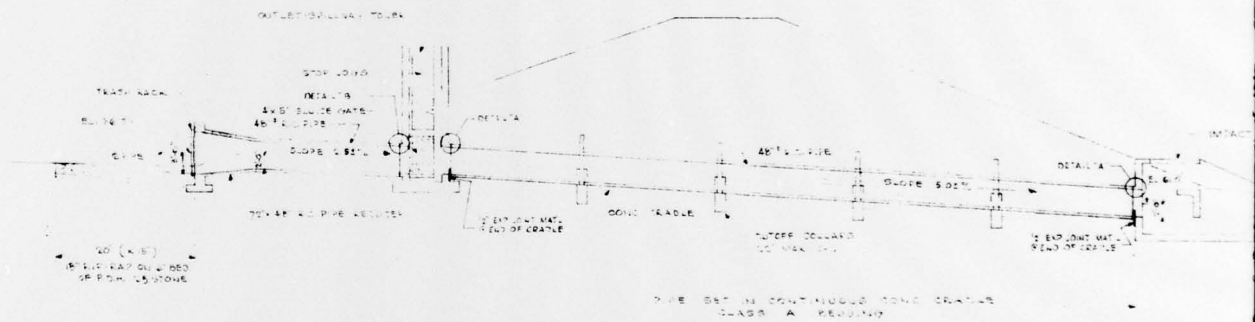
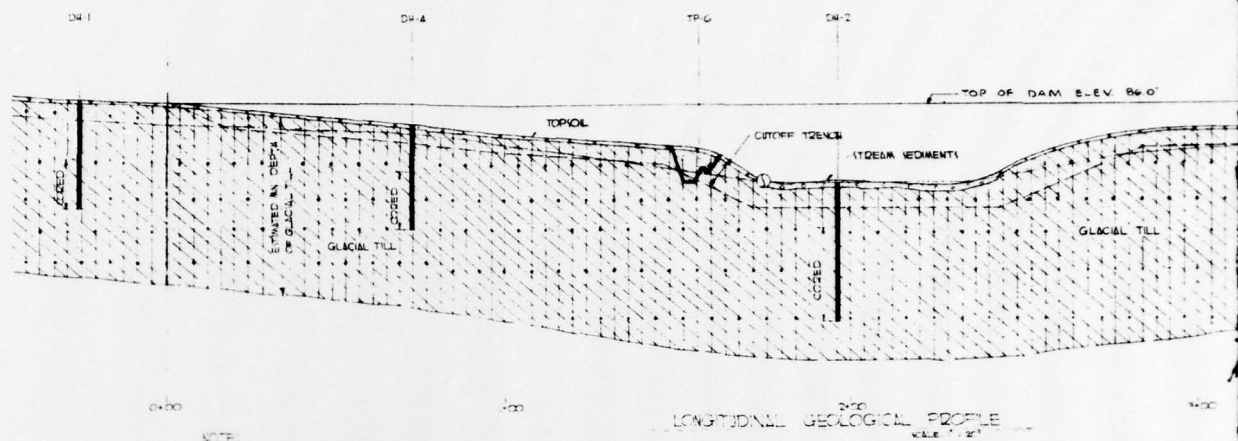


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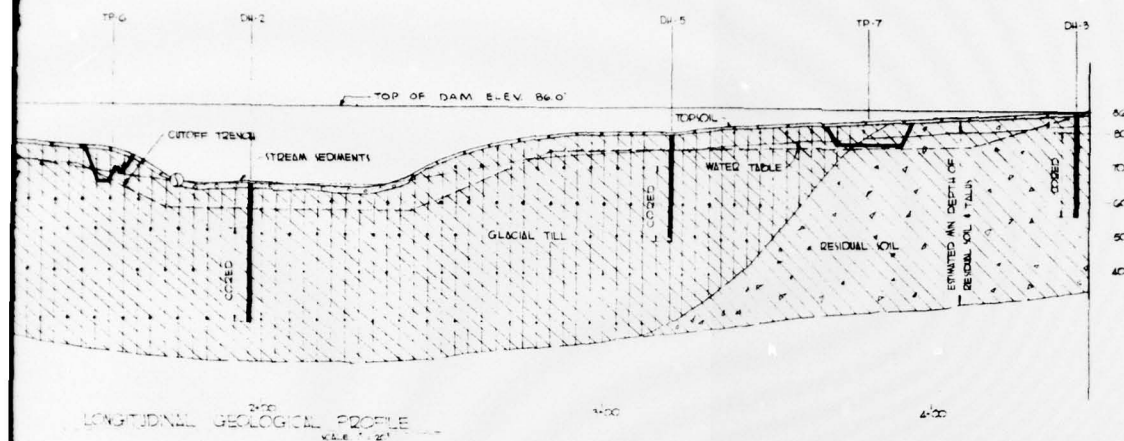


- EXISTING CONTOURS
- REVISED CONTOURS
- EDGE OF WATER & NORMAL POOL ELEVATION
- NATURAL LAKE & DRAINAGE CHANNEL
- COMPLETE DRAW DOWN LEVEL
- EXISTING DAM TO BE DEMOLISHED
- CONCRETE VASCONY BRIDGE RIVERCROSS
- AREA TO BE GRADED TOP SOILED & SEED'D
- DRIVE ROAD
- TEST PIT
- AUGER HOLE

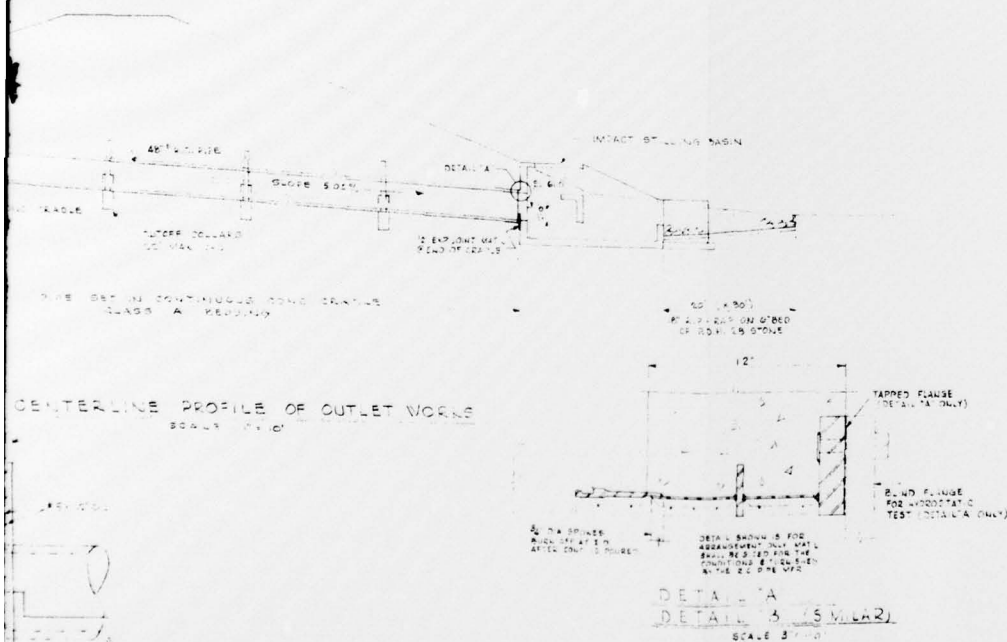
REVISED		APPROVALS		Project No. FC-82L (394-2)	
		APPROVED <i>Edith Bule</i>		AREA PLAN OF DAM	
		EXEC. DIR. FOR PENNSYLVANIA FISH COMMISSION		HUNTERS LAKE	
		APPROVAL RECOMMENDED <i>John R. Ryan</i>		Construction of Dam and Appurtenances	
		ENGINEERING DIVISION CHIEF ENGINEER		SHREWSBURY TWP. SULLIVAN COUNTY	
		SUBMITTED BY <i>R.C. Skelly</i>		ROBERT C. SKELLY, REGISTERED ENGINEER	
		BY		HARRISBURG, PENNSYLVANIA	
		ACCEPTED BY		SCALE	
		CONTRACTOR		COMMONWEALTH OF PENNSYLVANIA	
		BY		RAYMOND F. SHARER, SUPERVISOR	
		DRAWN BY	DATE	PENNSYLVANIA FISH COMMISSION	
		L.E.M. JR.	APRIL 1969	ROBERT J. D'AMICO, EXEC. DIRECTOR	
		CHECKED BY	DATE	HARRISBURG, PENNSYLVANIA	
		R.C.S.	APRIL 1969	SHEET NO. 3	



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- LEGEND
- TOPOG. & ORGANIC MATERIAL DARK BROWN
 - GLACIAL TILL COMPACT MIXTURE OF SLIGHTLY CLAYEY BEDDED SAND & GRAVELLED GRAVEL & COBBLES
 - RENDUVAL SOIL 1' TALL COMPACT MIXTURE OF RED GRITTY HEAVY CLAY AND CEMENT & MORTAR FRAGMENTS
 - RENDUVAL SOIL 1' TALL COMPACT MIXTURE OF LIGHT BROWN HEAVY SAND & GRAVELLED GRAVEL & COBBLES



REVISED				APPROVALS		Project No. FC-82L (394-2)	
				APPROVED: <i>Robert J. Kimball</i>		PROFILES OF DAM	
				EXEC. DIRECTOR: PENNSYLVANIA FISH COMMISSION		HUNTERS LAKE	
				APPROVAL RECOMMENDED: <i>R. Kimball</i>		Construction of Dam and Appurtenances	
				ENGINEERING DIVISION, CHIEF ENGINEER		SHREWSBURY TWP. SULLIVAN COUNTY	
				SUBMITTED BY: <i>R. Kimball</i>		ROBERT C. SKELLY, REGISTERED ENGINEER	
				CONSULTING ENGINEER		HARRISBURG, PENNSYLVANIA	
				ACCEPTED BY:		SCALE	
				CONTRACTOR		AS NOTED	
				BY:		COMMONWEALTH OF PENNSYLVANIA	
				DATE	CHECKED BY: E.C.S.	RAYMOND P. SHAPER, GOVERNOR	
				DATE	APRIL 1969	PENNSYLVANIA FISH COMMISSION	
						ROBERT J. BIRLO, EXEC. DIRECTOR	
						HARRISBURG, PENNSYLVANIA	
						SHEET NO. 5	

L. ROBERT KIMBALL & ASSOCIATES
CONSULTING ENGINEERS & ARCHITECTS
FIGURE 6

APPENDIX F

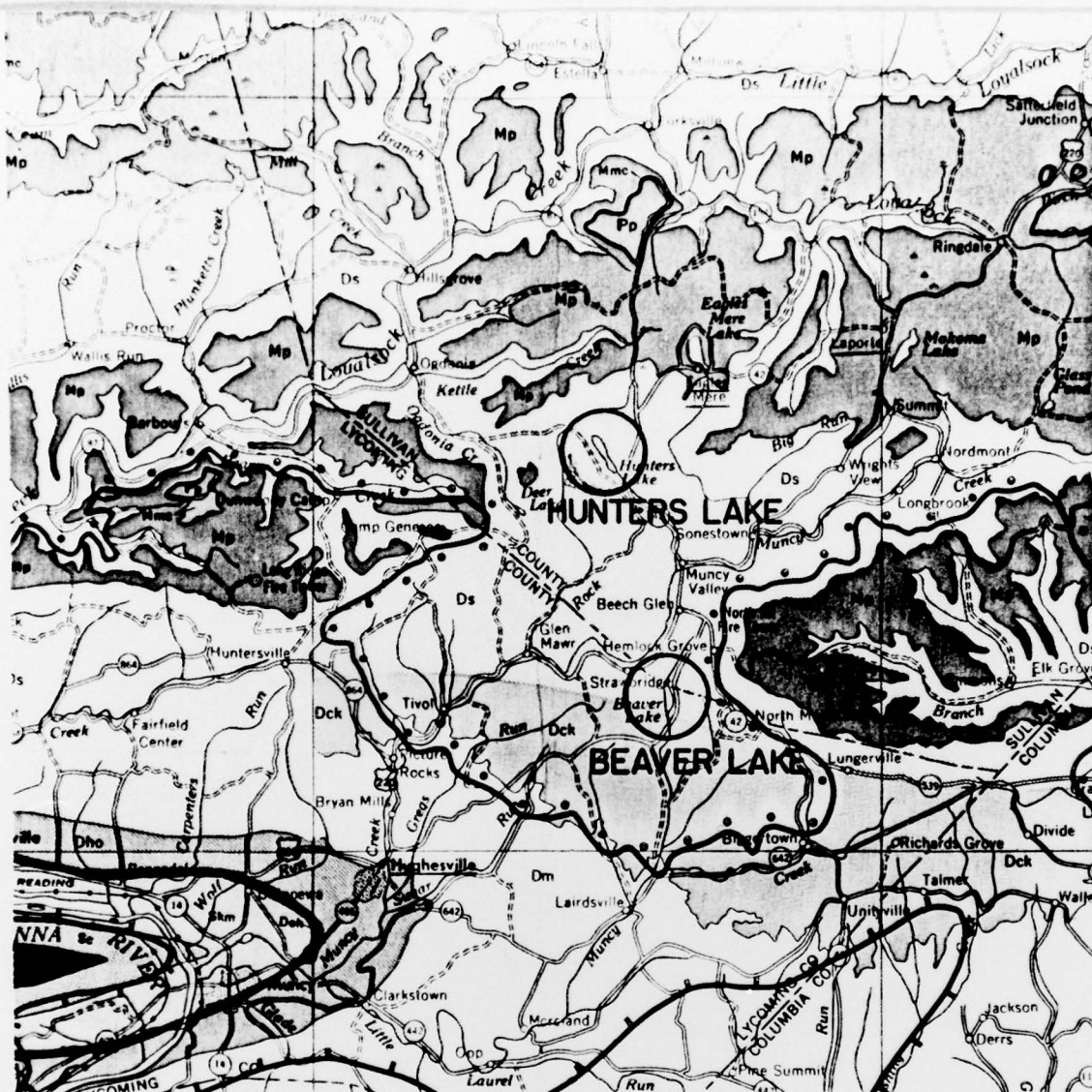
GEOLOGY

General Geology.

The Hunters Lake Dam lies within the Glaciated Low Plateaus Section of the Appalachina Plateaus Physiographic Province. This area is characterized by broad anticlines and synclines and little, if any, faulting. The topography has been modified by a blanket of glacial deposits.

The Bedrock under Hunters Lake Dam consists of the Devonian aged Susquehanna Group. This is a complex unit of sandstones, siltstones, shales and conglomerates. Usually the following changes occur from the bottom to the top of the group; the sediment grain size increases, the average thickness of the beds increases, the shales become redder, and the percentage of silica increases. The bedding is usually well developed with thicknesses ranging from less than one to over fifteen feet. The joints are usually closely spaced in a well developed, regular pattern in the shales and siltstones. The shales weather rapidly, while the sandstones, siltstones and conglomerates are moderately resistant. This group can form a good foundation for heavy structures if it is excavated to solid material and the shales and siltstones are kept water free. The surface drainage is moderate to good, except in glaciated regions, such as this one, where it is poor. The interstitial porosity is low in the coarser rocks while the joint development allows a medium quantity of total effective porosity.

The entire area around Hunters Lake has been subjected to depositional affects of continental ice sheets from the Wisconsin Stage of the Pleistocene. Geologic literature indicates that the Wisconsin ice sheet in this area had a thickness of at least 1500 feet and extended as much as five miles of the Sullivan County line. As a result of these glacial features compact preconsolidated deposits of relatively impervious glacial till blanket in the area thickness from a few feet to more than 100 feet. A few isolated deposits of previous outwash sediments from the glacier are scattered throughout the area. The filling and damming of preglacial stream valleys with glacial deposits has resulted in numerous swamps and natural lakes in the area. Hunters Lake on Trout Creek is a natural glacial lake dammed by and resting on a compact, relatively impervious deposit of glacial till. The till is a heterogenous merger of reddish silty and clayey sand with occasionally boulders.



GEOLOGIC MAP OF HUNTERS LAKE AND
BEAVER LAKE DAM
AREA



Oswayo Formation

Brownish and greenish gray, fine and medium grained sandstones with some shales and scattered calcareous lenses, includes red shales which become more numerous eastward. Relation to type Oswayo not proved.



Catskill Formation

Chiefly red to brownish shales and sandstones, includes gray and greenish sandstone tongues named Elk Mountain, Honesdale, Shokola, and Delaware River in the east.



Marine beds

Gray to olive brown shales, graywackes, and sandstones, contains "Chemung" beds and "Portage" beds including Hurket, Bralier, Harrell, and Trimmers Rock, Tully Limestone at base.



Susquehanna Group

Barbed line is "Chemung-Catskill" contact of Second Pennsylvania Survey County reports, barbs on "Chemung" side of line.

Scale: 1:250,000